
New Combinations in North American *Rosulabryum* (Bryopsida, Bryaceae)

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ABSTRACT. For the Flora of North America Project, five species are transferred to *Rosulabryum* J. R. Spence (Bryaceae). Two weedy European species, *Bryum bornholmense* Winkelmann & R. Ruthe and *B. rubens* Mitten, are transferred based on morphology and recent molecular results, as *R. bornholmense* (Winkelmann & R. Ruthe) J. R. Spence and *R. rubens* (Mitten) J. R. Spence. The western North American endemics *B. erythroloma* (Kindberg) Syed and *B. gemmascens* Kindberg are also transferred to *Rosulabryum*, as *R. erythroloma* (Kindberg) J. R. Spence and *R. gemmascens* (Kindberg) J. R. Spence. Finally, the rare eastern North American *Brachymenium andersonii* H. A. Crum is transferred to *Rosulabryum* as *R. andersonii* (H. A. Crum) J. R. Spence. In all, 13 species of *Rosulabryum* are found in North America north of Mexico. A key to the species is included.

Key words: *Brachymenium*, Bryaceae, *Bryum*, mosses, North America, *Rosulabryum*.

The genus *Rosulabryum* J. R. Spence was described to accommodate those species of *Bryum* Hedwig in sections *Rosulata* Müller Hallensis and *Trichophora* Kindberg (Spence, 1996). The type species is the Australian endemic *R. albolimbatum* (Hampe) J. R. Spence, a close relative of *R. andicola* (Hooker in Kunth) Ochya, which is widely distributed in the Southern Hemisphere, extending north through South America to the mountains of the American Southwest. These species are characterized by rosulate gametophytes, leaves that are mostly obovate with upper margins serrate, rhizoidal tubers, and peristomes that are unreduced. Superficially, the larger species of *Rosulabryum* are similar to species of *Rhodobryum* (Schimper) Limpricht. However, there are many differences between the two genera, including among others the abaxial stereid band (well developed in *Rosulabryum*, reduced or absent in *Rhodobryum*) and stolons (absent in *Rosulabryum*, present in *Rhodobryum*). Recent phylogenetic work using DNA sequence data suggests that they are not closely related (e.g., Cox & Hedderson, 2003) and has for the most part supported the concept of *Rosulabryum*. The most recent treatment of *Rosulabryum* is that for the

Australian species (Spence & Ramsay, 1999, 2005). Ochya et al. (2003) transferred 19 species of *Bryum* to *Rosulabryum*, including five known from North America. The genus is a large one, with ca. 75 to 80 species, and is especially well represented in the Southern Hemisphere.

In this paper, the species of *Rosulabryum* found in North America north of Mexico are discussed, with five additional species transferred here for the Flora of North America Project. Most *Bryum* species transferred to *Rosulabryum* have been previously monographed by Syed (1973) and Mohamed (1979) and are for the most part well accepted. Because the types of most of those found in North America have already been carefully examined by Crundwell and Nyholm (1964), Syed (1973), Mohamed (1979), Demaret and Wilczek (1982), and Wilczek and Demaret (1982), there is no need to re-examine them for the purposes of this study. Types for two poorly known western North American species, however, have been studied. Two species, *R. capillare* (Hedwig) J. R. Spence and *R. torquescens* (Bruch ex De Notaris) J. R. Spence, have already been transferred to the genus by Spence (1996) as part of the Flora of Australia Project (Spence & Ramsay, 2006). Recent molecular research has shown that *B. bornholmense* Winkelmann & R. Ruthe and *B. rubens* Mitten are apparently related to *R. capillare* (Holyoak & Pedersen, 2007) rather than to the species of the *Gemmabryum subapiculatum* (Hampe) J. R. Spence & H. P. Ramsay complex where they have recently been placed (Crundwell & Nyholm, 1964; Spence & Ramsay, 2005). This seemingly surprising result can be understood as the gametophytes of these two species are rather similar to some members of the *R. capillare* complex. Finally, the species known as *Brachymenium andersonii* H. A. Crum is transferred to *Rosulabryum* as its ecology, morphology, and distribution fit better there than in *Brachymenium* Schwägrichen.

The following transfers bring the number of species in *Rosulabryum* in North America north of Mexico to 13. In addition to the five transferred here, the following eight species are also found in the study area: *R. andicola*, *R. canariense* (Bridel) Ochya, *R.*

capillare, *R. elegans* (Nees) Ochyra, *R. flaccidum* (Bridel) J. R. Spence, *R. laevifolium* (Syed) Ochyra, *R. pseudocapillare* (Bescherelle) Ochyra, and *R. torques-cens*.

- 1. *Rosulabryum andersonii*** (H. A. Crum) J. R. Spence, comb. nov. Basionym: *Brachymenium andersonii* H. A. Crum, Bryologist 74: 47. 1971. TYPE: U.S.A. North Carolina: Macon Co., "Chestnut Ridge, 3 mi. NE of Highlands, on humus, moist depression in hemlock-hardwood woods," 4000 ft., s.d., L. E. Anderson 10051 (holotype, MICH not seen).

Although most species in *Rosulabryum* are distinctly rosulate, a few have evenly foliate stems. These include among others the Neotropical *R. densifolium* (Bridel) Ochyra, the Paleotropical-Australian *R. wightii* (Mitten) J. R. Spence, and the Australian-New Caledonian *R. subfasciculatum* (Hampe) J. R. Spence. *Brachymenium andersonii*, which also has evenly foliate stems, was described from material collected in North Carolina and has not been re-located since it was first found. It is sterile, and hence its placement in the traditional genera *Bryum* and *Brachymenium* cannot be completely resolved. Crum (1971) considered the species to be related to the evenly foliate *Brachymenium speciosum* (Hooker & Wilson) Steere of Mexico and Central America, while L. E. Anderson (in Crum, 1971) considered the species to be related to *Bryum densifolium* Bridel (\equiv *R. densifolium* (Bridel) Ochyra). I agree with L. E. Anderson, and in fact *R. andersonii* is morphologically very similar to *R. densifolium*, including details of the leaves and stems. Future work may ultimately show them to be conspecific. All other species in *Brachymenium* are tropical and subtropical epiphytes, typically found in montane cloud forests in the Paleotropics. They are also all rosulate. The evenly foliate stems, temperate distribution, and ecology (growing on soil) of *B. andersonii* are not found elsewhere in *Brachymenium*, but are common in *Rosulabryum*. Hence this species is transferred to *Rosulabryum*.

- 2. *Rosulabryum bornholmense*** (Winkelmann & R. Ruthe) J. R. Spence, comb. nov. Basionym: *Bryum bornholmense* Winkelmann & R. Ruthe, Hedwigia 38(3): 120. 1899. *Bryum murale* subsp. *bornholmense* (Winkelmann & R. Ruthe) J. J. Amann, Fl. Mouss. Suisse 2: 238. 1918. *Bryum erythrocarpum* subsp. *bornholmense* (Winkelmann & R. Ruthe) Podpěra, Preslia 2: 87. 1923. *Bryum erythrocarpum* var. *bornholmense*

(Winkelmann & R. Ruthe) C. E. O. Jensen, Förteckn. Skand. Växt., Moss. (ed. 2): 32. 1937. *Bryum atrovirens* subsp. *bornholmense* (Winkelmann & R. Ruthe) Wijk & Margadant, Taxon 8: 71. 1959. *Ptychostomum bornholmense* (Winkelmann & R. Ruthe) D. T. Holyoak & N. Pedersen, J. Bryol. 29: 119. 2007. TYPE: Denmark. "Auf der Insel Bornholm: Paradisbokker bei Nexø (Neksø) in einem kleinen Sphagnumsumpf auf einem schwach mit Erde bedeckten Granitblock aufgefunden," 13 July 1898, J. Winkelmann s.n. (holotype, BP not seen).

The recent molecular work by Holyoak and Pedersen (2007) shows that *Bryum bornholmense* and its close relative *B. rubens* are apparently closely related to *Rosulabryum capillare*. They place these and many other species in a morphologically highly variable *Ptychostomum* clade defined by molecular data only, including relatively few taxa from several different traditional genera. This clade can be interpreted as a group of genera, however; thus I have moved these species to the morphologically defined *Rosulabryum* rather than placing them in a molecularly defined *Ptychostomum* Hornschuch. Although traditionally placed in the *Bryum erythrocarpum* complex of Crundwell and Nyholm (1964), these two species are somewhat anomalous as they have serrate upper laminal margins, broad laminal cells, fairly distinct limbidia, and large tubers, all features of *Rosulabryum*. Crundwell and Whitehouse (2001) have provided several diagnostic criteria that distinguish the two species. The presence of true *R. bornholmense* in North America needs to be confirmed, as most specimens appear to be misidentified *R. rubens*, according to Crundell and Whitehouse (2001).

- 3. *Rosulabryum erythroloma*** (Kindberg) J. R. Spence, comb. nov. Basionym: *Bryum capillare* Hedwig subsp. *erythroloma* Kindberg, Eur. N. Amer. Bryin. 2: 358. 1897. *Bryum erythroloma* (Kindberg) Syed, J. Bryol. 7: 301. 1973. TYPE: Canada. British Columbia: Cedar Hill, Apr. 1887 (fr.), J. Macoun s.n. (neotype, designated by Syed, 1973: 304, CAN).

This species is distributed in western North America from British Columbia to Central America. A report from Bolivia (Allen, 2002) needs to be re-evaluated, as several similar species of *Rosulabryum* occur in South America. The taxon was raised to species rank by Syed (1973). *Rosulabryum erythroloma* is easily distinguished from *R. capillare* by several characters of the leaf and tubers, including its

overall red coloration, short stout leaf hairpoint, decurrent leaves, and red tubers. It generally grows at low elevations near coastlines (Syed, 1973; Spence, unpublished), although it has been found in montane areas in Central America.

4. ***Rosulabryum gemmascens*** (Kindberg) J. R. Spence, comb. nov. Basionym: *Bryum gemmascens* Kindberg, Eur. N. Amer. Bryin. 2: 360. 1897. TYPE: Canada. British Columbia: "Can. Vanc. isl.," 1893, *J. Macoun s.n.* (holotype, CAN).

This species is closely related to *Rosulabryum capillare*, but it differs in its orange-red tuber color (vs. brown) and the elongate evenly foliate innovations with small, somewhat imbricate leaves (vs. short rosulate innovations with contorted leaves). *Rosulabryum gemmascens* is a western North American endemic distributed from British Columbia to California.

5. ***Rosulabryum rubens*** (Mitten) J. R. Spence, comb. nov. Basionym: *Bryum rubens* Mitten, Hooker's J. Bot. Kew Gard. Misc. 8: 232. 1856. *Bryum erythrocarpum* subsp. *rubens* (Mitten) Dixon, Stud. Handb. Brit. Mosses 336. 1896. *Bryum murale* subsp. *rubens* (Mitten) J. J. Amann, Fl. Mouss. Suisse 2: 238. 1918. *Bryum erythrocarpum* var. *rubens* (Mitten) Podpěra, Preslia 2: 85. 1923. *Bryum radiculosum* var. *rubens* (Mitten) Margadant & During, Bekn. Fl. Ned. Blad. & Leverm. 443. 1982. *Gemmabryum rubens* (Mitten) J. R. Spence & H. P. Ramsay, Phytologia 87: 68. 2005. *Ptychostomum rubens* (Mitten) D. T. Holyoak & N. Pedersen, J. Bryol. 29: 120. 2007. TYPE: S. loc., s.d., s.n. (holotype, NY).

Rosulabryum rubens and *R. bornholmense* are closely related to *R. capillare* according to the recent molecular work of Holyoak and Pedersen (2007). Most North American material can probably be referred to *R. rubens*, based on the revisions of Crundwell and Whitehouse (2001).

KEY TO *ROSULABRYUM* OF NORTH AMERICA NORTH OF MEXICO

- 1a. Filiform gemmae present in axils of upper innovation leaves 2
1b. Filiform gemmae absent. 5
2a. Innovations short, rosulate, leaves large, mostly > 3 mm long, distal lamina margins strongly serrate, limbidium strong *R. andicola*
2b. Innovations rosulate or elongate and evenly foliate, leaves small, mostly < 2 mm long, distal lamina margins serrulate to almost smooth, limbidium weak or absent. 3

- 3a. Innovations rosulate, leaves obovate, flat, rhizoidal tubers red, filiform gemmae brown *R. laevifilum*
3b. Innovations evenly foliate, leaves ovate, concave, rhizoidal tubers various colors, filiform gemmae red, red-brown, or brown 4
4a. Rhizoidal tubers orange to pink-orange, brighter than rhizoids, filiform gemmae red. *R. pseudocapillare*
4b. Rhizoidal tubers and filiform gemmae brown. *R. flaccidum*
5a. Plants with elongate evenly foliate stems, leaves large, 2–4 mm long, distinctly decurrent, margins sharply serrate distally *R. andersonii*
5b. Plants rosulate or if evenly foliate then leaves small, < 2 mm long, and distal margins mostly smooth or only weakly serrulate; leaves decurrent or not 6
6a. Leaves medium-sized to large, 2–4 mm long, often in 2 or more interrupted tufts, margins serrate, limbidium strong or absent distally, costa excurrent in short stout hairpoint, lamina cells incrassate, distinctly porose 7
6b. Leaves mostly < 2 mm long, usually not in interrupted tufts, variously contorted, twisted, or imbricate, margins smooth to serrulate, limbidium present or nearly absent, costa various, not reaching apex to long excurrent in long hairpoint, lamina cells thin to firm-walled, not or weakly porose. 8
7a. Distal margins of leaves lacking limbidium, leaves often in 2 or more interrupted comal tufts, hairpoint recurved when dry. *R. canariense*
7b. Distal margins of leaves with strong limbidium, leaves usually in single tufts, hairpoint variously straight to curved but not distinctly recurved. *R. andicola*
8a. Stems ± evenly foliate, julaceous, leaves not much contorted when dry, distal margins of leaves with weak or absent limbidium, rhizoidal tubers absent. *R. elegans*
8b. Stems rosulate, although innovations sometimes evenly foliate, leaves variously contorted or twisted, rarely innovations or leaves imbricate, distal margin of leaf with strong to nearly absent limbidium, rhizoidal tubers present 9
9a. Plants with strong reddish tints, leaves distinctly decurrent, costa strong in short hairpoint *R. erythroloma*
9b. Plants green, brown-green to red-green, leaves not decurrent, hairpoint excurrent in short, medium, or long hairpoint. 10
10a. Plants polyoicous (synoicous, some shoots unisexual, others with unisexual lateral gametangia), rhizoidal tubers amber, orange, orange-red to crimson, generally lighter than rhizoids, distal leaf margins distinctly serrate, capsule often strongly nodding, red at maturity 11
10b. Plants dioicous, rhizoidal tubers red, orange-red, red-brown to brown, mostly same color as rhizoids, if brighter than tubers distinctly warty with protuberant cells, distal leaf margins serrate, serrulate to almost smooth, capsule often inclined, red-brown to brown. 12
11a. Tubers orange to amber, becoming brown with age, limbidium weak, leaves ovate. *R. bornholmense*
11b. Tubers bright red-orange to crimson, limbidium strong, leaves obovate *R. torquescens*
12a. Tubers with distinctly protuberant cells, dark red to red-crimson, clustered at base of stem on short

- rhizoids, distal lamina margins distinctly serrate, leaves irregularly contorted when dry *R. rubens*
- 12b. Tubers smooth or almost so, orange, red, or brown, mostly on long rhizoids away from stem base, distal lamina margins \pm smooth, if serrate then leaves spirally twisted around stem when dry 13
- 13a. Limbidium absent or weak, margins almost smooth, innovations elongate, of imbricate ovate leaves, somewhat reddish or red-brown, rosulate leaves irregularly contorted, tubers orange-red to red *R. gemmascens*
- 13b. Limbidium usually present, margins serrulate, innovations short, rosulate, green with leaves contorted, rosulate leaves twisted around stem, tubers brown-red to brown *R. capillare*

Acknowledgments. Many thanks to Ken Kellman, Dan Norris, Jim Shevock, and Alan Whittemore for discussions on the status of Californian species of *Rosulabryum*, and to R. Ochya and W. Weber for their support of my research. This work was supported in part by a grant from the Chanticleer Foundation to the Flora of North America Project. The Missouri Botanical Garden provided office space. Thanks are due to Richard Zander and Marshall Crosby for their support during my stay.

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